EFFECT OF PHONOPHORESIS AND MYOFASCIAL RELEASE IN PLANTAR FASCITIS- COMPARATIVE STUDY

Dissertation

Submitted to

The Tamilnadu Dr. MGR Medical University

In partial fulfillment for the degree of

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(Advanced P.T. in Orthopaedics)

Cherraan's College of Physiotherapy

Cherraan's Institute of Health Sciences

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CERTIFICATE

The work embodied in the thesis entitled "**EFFECT OF PHONOPHORESIS AND MYOFASCIAL RELEASE IN PLANTAR FASCITIS –COMPARATIVE STUDY" submitted to the The Tamilnadu Dr. MGR Medical University, Chennai** in partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY (ADVANCED P.T. IN ORTHOPAEDICS)**was carried out by candidate bearing register number **27103001** at Cherraan's College of Physiotherapy, Coimbatore under my supervision. This is an original work done by her and has not been submitted in part or full for any other degree/diploma at this or any other university/institute. The dissertation is fit to be considered for evaluation for award of the degree of Master of physiotherapy.

Signature of Supervisor	**Principal**
Mrs.Jency Thangasheela MPT	**Prof.Kamal Janakiraman MPT (PhD)**
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Project work evaluated on _____

DECLARATION

The work embodied in the thesis entitled **"EFFECT OF PHONOPHORESIS AND MYOFASCIAL RELEASE IN PLANTAR FASCITIS – COMPARITIVE STUDY "** submitted to **The Tamilnadu Dr. MGR Medical University, Chennai**, in partial fulfillment for the degree of Master of Physiotherapy, was the original work carried out by me and has not been submitted in part or full for any other degree/diploma at this or any other university/institute. All the ideas and references have been duly acknowledged.

Signature of the Supervisor **Signature of student**

Mrs.Jency Thangasheela MPT

Professor

Date: _____

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ABSTRACT

Background and objectives: Plantar fascitis is an inflammatory condition which causes pain and stiffness in the heel and medial arch of the plantar surface of the foot. It is most common in middle age group and among those participating in running sports. Phonophoresis and myofascial release has been used in physiotherapy individually for the treatment of plantar fascitis and proved effective in reducing pain and improved functional status of the patient. The study proposed to compare the efficacy of Phonophoresis and myofascial release to treat plantar fascitis.

Method: 30 subjects were divided equally into two groups each containing 15 subjects of both sexes. The group A received Phonophoresis treatment and the group B received myofascial treatment. The data was collected from all the patients on 1^{st} day and on the 10^{th} day of intervention by using two parameters, VAS and FFI

Result: This study shows significant difference between groups i.e. group A (Phonophoresis) and group B (myofascial release). The mean ±SD VAS for group A was 4.80±0.94 while that for group B was 3.93±1.09 with p value (<0.41) and the mean ± SD FFI for group A was 0.44±0.09 while that for group B was 0.31±0.17 with p value (<0.015) showed statistically significant differences between groups.

Conclusion: Based on this outcome Phonophoresis is found to be more effective in reducing pain and improve functional status of the patient when compared with the Myofascial release in subjects with plantar fascitis.

Keywords: Plantar fascitis, Phonophoresis, Myofascial release, VAS scale, Foot functional index.

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Plantar Fascitis (“plarn-tar-fashy-ey-tiss”) is one of the most common causes of foot pain. It is a repetitive injury of medial arch and foot. It is defined as an inflammatory condition that occurs as a result of overstressing the plantar fascia. In 1812, Wood described, Plantar fasciitis which has been referred by various synonyms, heel pain syndrome, subcalcaneal pain syndrome, calcaneodynia, subcalcaneal bursitis, calcaneal periostitis, neuritis, heel spur syndrome, subcalcaneal spur syndrome, stone bruise, medial arch sprain, runner’s heel, jogger’s heel and policeman’s heel. Although, plantarfascitis can seem quite debilitating during the acute phase, it rarely causes lifelong problems. It is estimated that 10% of world’s population will experience the condition during their lifetime.

Plantar fascia (aponeurosis) is the thick fibrous band of tissue in the sole of the foot. Plantar aponeurosis is composed of central, lateral and medial bands that originate along the medial tubercle of the calcaneus. Plantar fascia courses anteriorly along the arch of the foot, whereas the fascia divides into slips which eventually insert into the sides of the proximal phalanx in each toe and blend with the flexor tendon sheaths and transverse metatarsal ligament of each toe.

Plantar fascia is the main stabilizer of the medial longitudinal arch of the foot against ground reactive forces and instrumental in reconfiguring the foot into the rigid platform before toe-off. Under normal conditions, the plantar fascia performs this function appropriately without incurring injury. Plantar fasciitis occurs when the band of tissue is overloaded or overstretched. This tension produces small tears in the fibers of fascia, especially where the fascia meets the anterior calcaneus. Some theories believe that plantarfascitis to be an entrapment neuropathy involving the branch to abductor digitiminimi (BAXTER).It has been reported that Plantarfascitis is associated with long periods of weight bearing. In the non-athletic population, it is most frequently seen in weight bearing occupations. 65% of non-sports demographics are over weight with unilateral involvement in most of the cases. Second major distribution in athletic population, 10% of all running athletes. Basketball players, tennis, football players and long-

distance runner and dancers have noted high frequency of plantar fasciitis. Studies have indicated an association between plantar fasciitis and individuals whose body mass index is 30 kg/m2 or higher. (Evidence Based treatment of P;antarfascitis – Joshuba dublin)

Plantar fascia is not elastic and therefore cannot stretch when forces on the foot to flatten the arch become too great. Because of its inelasticity, the plantar fascia begins to separate from the weakest point of attachment, often the heel bone resulting in pain and inflammation that is distinct and treatable. The chief complaint will be sharp pain in inner aspect of the heel and arch of the foot with the first few steps in the morning and later the pain diminishes and becomes intense during prolonged weight bearing. Study surmised that pain due to plantar fasciitis may be due to one of the following mechanisms: “irritation of pain fibers by repeated trauma or chronic pressure from a thickened plantar fascia, ischemic pain from chronic pressure from a thickened plantar fascia against digital vessels, enhanced effect of local pain chemicals such as substance P and glutamate and increased nociceptor sensitivity secondary to inflammation”.(Babcock et al)

NEED FOR THE STUDY

Plantarfascitis has different modalities of treatment. Results of these treatment protocols vary with each clinical setting. Phonophoresis and myofascial release are two methods commonly used by physiotherapists for the treatment of plantarfascitis. It cannot be claimed that one modality is superior to the other.

This study is a comparative study between myofascial release and phonophoresis for the treatment of plantarfascitis.

Both of the above methods can be applied in outpatient settings by the therapist and can also be combined together.

This study only compares the benefits of both modalities and will highlight the advantage of one modality over the other.

AIM AND OBJECTIVES OF THE STUDY

AIM OF THE STUDY

To evaluate the effectiveness of myofascial release and phonophoresis on function of the people with plantar heel pain

OBJECTIVES OF THE STUDY

- To evaluate the efficacy of phonophoresis in reducing pain and improving function in patients with plantar fascitis
- To evaluate the efficacy of myofascial release in reducing pain and improving function in patietns with plantar fascitis
- To compare the efficacy of phonophoresis and myofascial release in the treatment of patients with plantarfascitis.

HYPOTHESIS

NULL HYPOTHESIS:

There is no significant difference between Phonophoresis and myofascial release in reducing pain and improving function in patients with plantar fasciitis.

EXPERIMENTAL HYPOTHESIS:

There is a significant difference between Phonophoresis and Myofascial release in reducing pain and improving function in patients with plantar fasciitis.

TYPES OF PLANTARFASCITIS:

The four recognized types of plantarfascitis are systemic, traumatic, degenerative and mechanical (Overuse)

The mechanical or overuse type of plantarfascitis is caused by excessive pronation, which results in microtears. The patient history almost always indicate a change in their level of activity, whether it be a dramatic increase in running mileage over a short period or a change in the level of activity at work.

The most common mechanical cause is excessive pronation of the foot, which increases the level of stress to the plantar fascia and surrounding intrinsic muscles. Increased stress is also placed on the calcaneal insertion of the plantar fascia, as a result of the excessive foot pronation. A bony hypertrophy of the medial plantar tubercle can occasionally occur at the site of the plantar fascia attachment, which is termed as heel spur.

In general, the mechanical and degenerative forms of plantarfascitis are commonly referred for treatment. These two types of plantar fasciitis are often seen in patients participating in endurance sport, in occupation requiring prolonged standing. These patients often complain of severe heel pain first in the morning. Most of the patients with plantarfascitis will be able to feel pain in the morning as the fascia tightens up during the night and pain decreases when the tissue warms up or after getting up from the bed.

Age related degenerative changes to the plantar fascia and to the fat pad of the heel may predispose to injury by decreasing the shock absorption capabilities of the foot and the ability of the plantar fascia to dissipate tensile forces.(extracted from evidence based practice of plantar fascitis by Joshuba Dubin)

PATHOMECHANICS:

The plantar fascia is tight over the plantar surface of the base of the toes during the toe-off. Due to the limited elastic qualities of the plantar fascia, the arch is slightly raised, creating the rigid lever to apply the results of the forceful gastrocnemius contraction.

Hicks, an English anatomist postulated that the plantar fascia, which originates from the antero-medial plantar aspect of calcaneal tuberosity, is under constant traction as it is pulled distally around the drum of windlass. (Metatarsal heads) This tightening of the cable, so to speak, elevates the longitudinal arch, but in doing so places traction on the origin of plantar fascia. This is known as "WINDLASS EFFECT"(**Campbell Text book of orthopaedics 1995**)

The plantar fascia is an important elastic support for the longitudinal arch which exerts its maximal pull on the plantar fascia, especially its origin on the medial process of calcaneal tuberosity. The plantar fascia elongates with increased loads to act as a shock absorber, but its ability to elongate is limited.

Problem usually arises with repetitive stress on the insertion of the plantar fascia. This leads to a pulling away of the fascia from the heel bone which causes inflammation and therefore pain. Injury may also occur at the sole or towards the toes.

As the fascia is pulled away from the bone, the body reacts by filling in the space with new bone. This causes the classic heel spur. This heel spur is a side effect and not the cause of the problem.

RISK FACTORS:

- Sudden gain in body weight
- Unaccustomed walking or running
- Shoes with poor cushioning
- Increase in running distance and intensity
- Change in walking or running surface

- Tightness of Achilles tendon
- Occupations involving prolonged weight bearing
- Structural abnormalities like ankle equines, forefoot varus, pes planovalgus pes cavus which causes pronation of foot

Treatments for plantar fasciitis can be given by means of

- Conservative care (electric modalities, patient education, soft tissue therapy/massage, acupuncture, taping ,night splints, stretching ice, heat strengthening and orthotics
- Extra-corporeal shock wave therapy
- Injections and medications
- Surgical interventions

MYOFASCIAL RELEASE:

Myofascial release has been one of the physiotherapy treatments given in the chronic condition that causes tightness and restriction in soft tissues.

Myofascial release is a soft tissue mobilization technique. It utilizes the stretching of the fascia and muscle to increase ROM or to decrease pain by breaking up these adhesions in the fascia.

Fascia is the connective tissue and it is divided into three different layers. First layer is superficial fascia consists of connective tissue and adipose tissue. It provides a path for nerve and blood supply. Second layer is the potential space. This area can become inflamed, which shows that it can be injured or stretched with any type of injury. First layer is deep layer and is dense connective tissue that covers all muscles and organs of the body. Myofascial release techniques stem from the foundation that fascia, a connective tissue found through out the body reorganizes itself in response to physical stress and thickness along the lines of tension. Breaking the adhesions between the fascia and muscle allows the muscle and fascia to move smoothly over each other and helps alleviate the problem.

By myofascial release there is a change in the viscosity of the ground substance to a more fluid state which eliminates the fascia's excessive pressure on the pain sensitive structure and restores proper alignment. This is accomplished by relaxing contracted muscles, increasing circulation, increasing venous and lymphatic drainage and stimulating the stretch reflex of muscles and overlying fascia**.(myofascial manipulation theory and clinical application 2nd edition Robert I cantu)**

PHONOPHORESIS:

Phonophoresis is the technique of movement of the drugs through the skin in to the subcutaneous tissues under the influence of ultrasound. It acts as a fast, painless, non invasive alteration to local injection.

The application of low frequency sound waves (ultrasound) to the skin increases the permeability of the skin and raises the temperature 7-9degree F (4-5 degree C) up to 3 inches (8 cm) below the skin surface within a localized area.

In phonophoresis, drugs are applied to the skin before ultrasound treatment. Ultrasound waves disrupt the lipid (fat) layer in the cell membrane of the skin cells on the surface of the body. These cells create the strongest barrier to drug penetration. Ultrasound creates a channel in the cell membrane and drives the drug through the barrier and deeper into the tissues**.(Electrotherapy explained Val Robert son)**

Once the drug penetrate, it is likely to be dispersed in circulation which depends on the vascularity of the tissues and the ease with which molecules of the drug can enter the blood vessels.

Pulsed wave ultrasound appears to be more beneficial than continuous. Patients will not experience heat build up and this will allow stationary ultrasound

head placement to drive drugs into the area of discomfort or dysfunction**.(Electrotherapy explained alex ward)**

A study conducted to compare the effect of phonophoresis, ultrasound and placebo ultrasound therapies in the treatment of myofascial syndrome (MPS).Patients were allocated into three groups.Group1(n=20)received diclofenac phonophoresis,Group2 (n=20)received ultrasound and Group 3 (n=20) received placebo ultrasound therapies over trigger points, 10 minute a day for 15 session during 3 weeks (1MHZ-1.5 Watts/cm) additionally, all patients were given neck exercise program including isotonic, isometric and stretching result showed there was statistically significant improvements in pain severity, number of trigger points, pressure pain threshold, range of motion and the neck pain disability index scores both in phonophoresis using diclofenac and ultrasound therapy were effective in the treatment of patients with myofascial pain syndrome. **(Ay S, Dogan SK Eveik D, Baser OC, 2010)**

A study done to know the effect of myofascial release(MFR) in an adult with idiopathic scoliosis and concluded that they improved with pain levels, trunk rotation, posture, quality of life, and pulmonary function. (**Le Bauer A, Brtalik R, Stowe K, 2008)**

Study to assess the reliability and validity of the visual analog scale for disability in patients with chronic musculoskeletal pain and results showed that the reliability study raw values varied from 0.60 to 0.77;and in the validity study rho values of VAS disability scores with SF-36 domain scores varied from 0.16 to 0.51, with Roland-Morris Disability Questionnaire scores from 0.38 to 0.43 and with VAS pain scores from 0.76 to 0.84 and concluded that the study was that the reliability of the VAS for disability is moderate to good. **(Anne M Boonstra, Henrica R Schiphorst Preuper, Michiel F Reneman, Jitze B Posthumus, Roy E Stewart 2008)**

Study to test the reliability and validity of the Taiwan Chinese Version of the Foot Function Index (FFI) among patients with plantar fasciitis and ankle/foot fracture patients volunteered for the cross-sectional survey and 24 were re-retested later and pain subscale and the activity limitation subscale were used and they concluded that the adapted Taiwan Chinese version of the FFI is reliable and valid and can be applied among traumatic and non-traumatic foot disorders.(**Wu SH, Liang HW, Hou WH,2008)**

Study to compare the effectiveness of iontophoresis and phonophoresis with diclofenac sodium in medial tibial stress syndrome. Diclofenac sodium is a non - steroidal anti inflammatory drug. Twenty five patients were used in the study. All of the patients were suffering from pain within their anteromedial lower leg. They were randomly divided in to two groups. The first group received iontophoresis treatment and the second received phonophoresis treatment. The treatment was given five times a week for two weeks and concluded that iontophoresis and phonophoresis both proved to lower pain and decrease inflammation. (**Andy Mancuso 2008)**

A study of RCT to find the effectiveness of myofascial Release in Treatment of Plantar fasciitis using 30 subjects Who were randomly allocated to study groups .Group A (control) received therapeutic ultra sound (1 MHz, 1 Watt/cm2,pulsed mode 1:4,5 minutes), contrast bath for 20 minutes, foot intrinsic muscles strengthening exercises, plantar fascia stretching exercises and group B (experimental) received conventional treatment as group A added with myofascial release for 15 minutes for 10 consecutive days and the outcome was assessed with VAS and Foot Function Index and found that there was significant change in pain relief as per the VAS score (p=0.000) and functional ability as per Foot Function Index (p=0.024).It is concluded that myofascial release is a effective therapeutic option in the treatment plantar fascitis (**Suman Kuhar, Khatri Subhash , Jeba 2007)**

A study to compare the effects of topical hydrocortisone and Clobetasole phonophoresis on reduction of pain with osteoarthritic knee joint. An experimental single blind randomized clinical trail (RCT) was used. 60 subjects with osteoarthritic knee (Tibio femoral) joints were randomly assigned to six groups. Group 1 – Ultrasound with acoustic gel, group 2 – Placebo ultrasound with hydrocortisone, group 3 – Placebo ultrasound with Clobetasole, Group 4 – Hydrocortisone phonophoresis, Group 5- Clobetasole phonophoresis, Group 6 – Placebo ultrasound with acoustic gel. All of the patient received treatments for ten sessions and the results showed that groups 1,4,5 showed a significant decrease in pain and edema and an increase in knee ROM and twenty meters walking test time ($P<0.05$). Additionally there was a significant difference in improvement rates between group 5 and 1 and 4 and concluded that both hydrocortisone and Clobetasole phonophoresis were more effective than ultrasound and acoustic gel on osteoarthritic pain of knee joint.(**Tohid Sedghimehr and Farid Bahrpeima 2006).**

A study to examine the therapeutic effects of phonophoresis with ketoprofen in gel form in patients with enthesopathy of the elbow. The research group consisted of 19 patients diagnosed with endesopathy of the lateral and medial epicondyle. In the statistical analysis we included 28 elbow joints treated with phonophoresis. The effects of therapy were compared with a control group of 20 patients who were treated with only ultrasound therapy. The therapeutic series consist of 10 treatments using the pulse mode of ultrasound and an intensity of 0.8 W/Cm2 in both groups. The pain symptoms in the elbow result in most of the patients. There were statistically significant differences between phonophoresis and ultrasound therapy and they concluded that the application of phonophoresis with Ketoprofen in the treatment of epicondylitis. **(Cabak.A, Maczewska M, Lyp M, Dobosz J, Gasaorowska U 2005)**

A study to compare the effectiveness of ibuprofen phonophoresis with conventional ultrasound therapy in knee osteoarthritis . 60 patients were randomly

assigned. Continuous ultrasonic waves of 1 MHZ frequency and 1 W/cm 2 power were applied for 5 minutes to the target knee joint. Acoustic gel without any pharmacological agent was applied in the ultrasound group, whereas cream containing 5% ibuprofen was applied in the phonophoresis group for a total treatment period of 10 sessions. Pain scores, knee ROM degrees, 20 meter walking time measurements and all global assessment scores also improved significantly in both groups , and it showed no significant differences between two groups and concluded that both therapeutic modalities were found to be effective and generally well tolerated after 10 therapy sessions. (**Kazanluk E, Basaran S, Guzel R, Guler-Uysal F, 2003**)

A study to compare the phonophoresis versus topical application of Ketoprofen. Comparison between tissue and plasma levels where twenty six patients with knee disorders requiring arthroscopy were randomly assigned to 1 of 3 groups than group A and the result of the study confirms that phonophoresis of ketoprofen allows the attainment of higher local concentrations, whereas systemic exposure is lower. The results indicate that, in contrast to sham phonophoresis , ultrasound can increase the transdermal delivery of ketoprofen. **(Barbara Cagnie, Elke Vinck , Steven Rimbaut and Guy Vanderstraetan , 2003)**

Study on tissue- specific plantar fascia stretching exercise enhances outcomes in patients with chronic heel pain. One hundred and one patients who had chronic proximal plantar fasciitis for duration of at least ten months were randomized into one of two treatment groups. The patients received instructions for either a plantar fascia tissue stretching program(Group A) or an Achilles tendon stretching (Group B) .All patients completed the pain and subscale of the Foot Function Index and concluded that a program of non-weight bearing stretching exercises specific to the plantar fascia is superior to the standard program of weight bearing Achilles tendon stretching exercises for the treatment symptoms of proximal plantar fasciitis**.(Benedict F DiGiovanni et al, 2003)**

Comparative study to see the effects of phonophoresis and iontophoresis of naproxen in the treatment of lateral epicondylitis . Naproxen was applied to the first group using phonophoresis(29 patients -33 extremities) and to the second group using ionotophoresis (32 patients- 34 extremities) and pin scores decreased, grip strength and Nirsch Petterone Grading System statistically significantly increased in both groups after treatment ($p<0.05$),but there were no statistical difference treatment ($p>0.05$) and the results suggest that iontophoresis and phonophoresis of naproxen are equally effective electrotherapy methods in the treatment of lateral epicondylitis. **(Ferdi Baskurt, Ayse Ozcan , Candan Algun, 2003)**

Study for the treatment of proximal plantar fasciitis with ultrasound-guided steroid injection, proximal plantar fascia and heel pad were assessed with a 10 MHZ linear array ultrasound transducer. Pain intensity was quantified with a tenderness threshold (TT) and visual analog scale (VAS) and was concluded that ultrasound offers an objective measurement of the therapeutic effect on proximal plantar fasciitis. Accurate steroid injection under ultrasound guidance can effectively treat proximal plantar fasciitis. **(TSAI Wen-Chung, WANG Chung-Li, TANG Funk-Tan, HSU Tsz-Ching , HSU Kuang-Hung, WONG May-Kuen 2000)**

Comparative study to find the efficacy of ultrasound and phonophoresis (Phonophoresis) , in the treatment of painful shoulder syndrome and the research comprised 64 patients, divided in two groups and the objective measurable parameters were recorded the results of showed that the objective parameters-phonophoresis is more efficient (retroflexion-$p< 0.05$). Nevertheless, phophoresis (diclofenac gel) proved much more efficient in reducing pain at rest ($p<0.01$) and in motion ($p<0.05$)(**Odjel za fizikalnu medicine, rehabilitaciju I reumatologiju, Klinicka bolnica Split, Marmontova. 1999)**

Study on phonophoresis versus ultrasound in the treatment of common musculoskeletal conditions where forty-nine subjects with soft tissue injuries including epicondylitis, tendinitis, and tenosynovitis were randomly assigned(double blinded technique) to PH or US treatment groups. Both groups received 8 minute of continuous US at 1.5 w/Cm2 , three times per week for 3 week. For the PH group a gel containing 0.05% fluocinonide was used as a coupling agent and the result showed a significant decrease in pain level and an increase in pressure tolerance ($P<0.05$), but there were no differences between groups from the onset of treatment to the end of week 3 and concluded that US results in decreased pain and increased pressure tolerance in these selected soft tissue injuries. The addition of PH with flucocinonide does not augment the benefits of US used alone.(**Klaiman MD, Shrader JA, Danoff JV, Hicks JE, Pesco WJ, Ferland J, 1998)**

Study to see the effects of ultrasound and Trolamine Salicylate Phonophoresis on Delayed-Onset Muscle soreness. Repeated eccentric contractions were used to induce DOMS in the elbow flexors of 40 college-aged women. Muscle soreness and active elbow range of motion were assessed daily prior to each treatment and concluded that ultrasound enhanced the development of DOMS but this enhancement was offset by the anti-inflammatory –analgesic action of salicylate phonophoresis. These findings suggest that salicylate phonophoresis may be useful in clinical situations in which it is desirable to administer ultrasound without increasing inflammation.(**Charles D Ciccone, Brain G Leggin and John Callamaro 1991).**

The study included a sample of 30 subjects who were diagnosed as having plantarfascitis and referred to Physiotherapy Outpatient Department of Cherran's College of Physiotherapy.

STUDY DESIGN:

Comparative study with Pre and Post test design for both control and experimental group

STUDY SETTING:

Subjects for the study were chosen from the outpatient department of the Cheraan's College of Physiotherapy who were diagnosed as having plantar fasciitis by an Orthopaedician. Consent to carry out the study was granted by the Institutional Ethical Clearance Committee.

POPULATION STUDIED:

Population for the study were chosen from the patients referred to the Physiotherpay Department and also clinically diagnosed Plantarfascitis and willing to take the treatment for 10 successive days were enrolled for the study .

SAMPLE SIZE AND SAMPLING TECHNIQUE:

SAMPLE SIZE:

30 subjects

Groups	:	Two groups	
Group A	:	Phonophoresis	15 patients
Group B	:	Myofascial Release	15 patients

SAMPLING TECHNIQUE:

Simple Random Sampling

A sample of 30 patients was assigned randomly into Group A (Phonophoresis and conventional Therapy) N=15 and Group B (Myofascial Release and conventional Therapy) N=15 in 35- 55 years of age group. Samples were randomly chosen from the outpatient department observing the inclusion and exclusion criteria.

Patients were assessed by the use of an assessment performa (Appendix)

DATA COLLECTION:

30 subjects diagnosed as plantarfascitis were selected for the study. Those subjects were with the age group between 35-55 years of age. They were selected by simple random sampling method and divided into control and experimental group.

- The date were collected before and after the treatment for both the groups. The pre score we obtained before the intervention applied to both the groups. The post score was obtained from the subjects after the treatment sessions.

INCLUSION CRITERIA:

Subjects were selected for the study if they fulfilled the following criteria.

- Plantar fasciitis due to mechanical pain
- Patients between ages of 35-55 years of age of both genders
- Patients with heel pain felt on the first step in the morning, weightbearing , after walking and running.
- Patients suffering from plantar fasciitis for the last one and half months

EXCLUSION CRITERIA:

The subjects who were excluded were subjects with

- Infective conditions of foot, tumor, calcaneal fracture, metal implant around the ankle
- Dermatitis
- Impaired circulation to lower extremities
- Corticosteroid injection within a year to heel
- Diagnosed of plantar fasciitis with calcaneal spur
- Rheumatoid arthritis

MATERIALS USED:

- Couch
- Ultrasound
- Tennis Ball
- Towel
- Diclofenac sodium gel
- Poor function index

DURATION OF THE STUDY

10 days

PARAMETRES:

Assessment was conducted on the first day and last day of the treatment session by the following parameters.

- Foot function Index
- Visual analog Scale

FOOT FUNCTION INDEX:

It is a questionnaire that has 17 questions related to pain affected different functions and activities and Pain severity for the questionnaire was measured using a similar scale as the patient assessment with 10 representing severe pain or inability to function.

VISUAL ANALOG SCALE:

A horizontal scale of 1 to 10 on which subjects were made to grade the intensity of pain and a 10 cm scale with 0 to 10 marking was drawn and subjects were asked to show mark on scale which is best defined the level of pain.

PROCEDURE:

An ethical clearance was obtained from Ethical Committee of Cherran's College of Physiotherapy. Subjects who fulfill the criteria were included in the study. An informed consent was obtained from the subjects. The subjects were assigned into two groups, Group A and Group B by simple random sampling. Before the treatment initial pain level should be recorded by using VAS and Foot Function Index (FFI) in both groups.

Position of the subject : Phonophoresis – Prone position
Myofascial release – Supine position

GROUP A

Patients receive phonophoresis along with conventional treatment. Diclofenac sodium gel was used in phonophoresis. Ultrasound was used with the output of 1 W/cm2 for 5 minutes and pulsed mode 1:4 ratio with frequency of 1 MHZ for 10 sittings for 10 consecutive days.

GROUP B

Patients received myofascial release along with conventional treatment by using thumb, plantar cupping and fingers for 15 minutes. Patient in supin lying with heel out of the couch. Therapist stands near the couch with one hand over the toes for stabilization and the other hand moved down along the direction of fascia and the myofascial stretch is held for 20 seconds, given slowly and subsequently feeling the tissues under the hands getting relaxed, the stretch is further increased and maintained for 90 seconds.

CONVENTIONAL THERAPY

It includes the following

1. **Contrast bath was given for 20 minutes for 10 days**
2. **Exercises for intrinsic muscles strengthening:**

- ❖ Towel Curl-up: For towel curl ups participants sat with foot flat on the end of towel placed on a smooth surface small weight is kept at the end of the towel. Keeping the heel on the floor, the towel was pulled towards the body by curling the towel with the toes, for 10 minutes.
- ❖ Active ankle exercises:
- ❖ For active ankle exercises- dorsiflexion, plantarflexion ,inversion and eversion in supine lying for 10 times.
- ❖ TA stretching: Active tendon Achilles stretching in standing by leaning against the wall, holding each stretch for 1 minute and repeating 5 times each session.
- ❖ Plantar fascia stretching with tennis ball, subjects sitting on the chair rolling foot on the ball for 5 minutes

3. **Interventions were given for 10 days.**
4. **At the completion of tenth physical therapy sessions outcome measures were re-evaluated and pre and post scores were compared.**

A comparative study with 30 plantar fasciitis subjects out of which 15 were males and 15 were females randomized in 15 subjects in phonophoresis and 15 subjects in Myofascial release is undertaken to study the effect based on VAS and Foot Function Index. All subjects fulfilled the inclusion and exclusion criteria.

Descriptive statistical analysis has been carried by using SPSS version 20 in the present study and alpha value set at 0.05.

1. Unpaired t- test was used to test the age difference among the both the groups.
2. Chi-square test was used to test for gender difference among both the groups.
3. Wilcoxon test was used to find out the significant difference of VAS and FFI
4. Mann- Whitney U test was used to find out the significant difference in VAS and FFI between the groups.

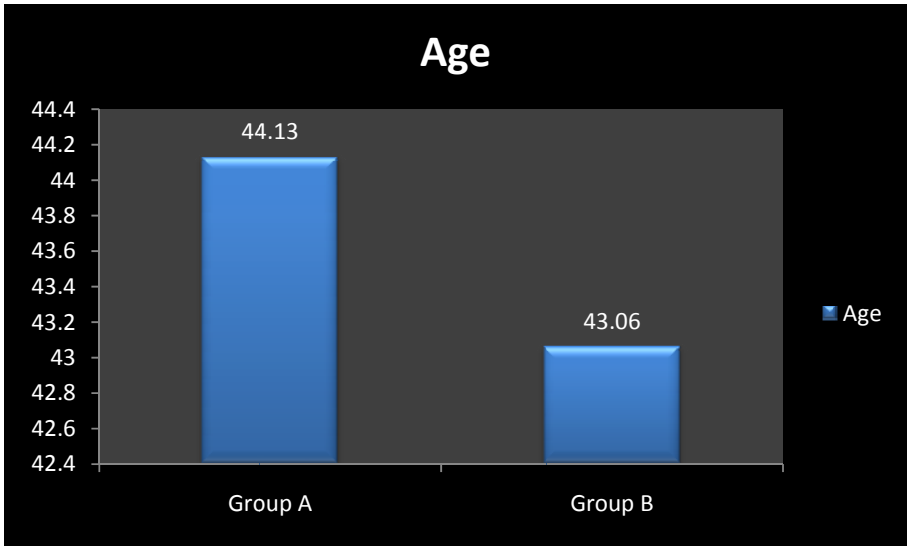
Microsoft word and Excel have been used to generate graphs, tables etc

Table 1: Base line data for demographic variables

SI. No.	Variable	Group A	Group B	P value
1	Age	44.13±6.4	43.06±6.8	>o.664
2	Sex(m/f)	6/9	9/6	>0.273

RESULTS :

The above tables shows that in the study group A mean age was 44.13 with a SD of 6.4 where as in group B mean age was 43.06 with a SD of 6.8 and there was no significant difference among both groups (P value >0.664)



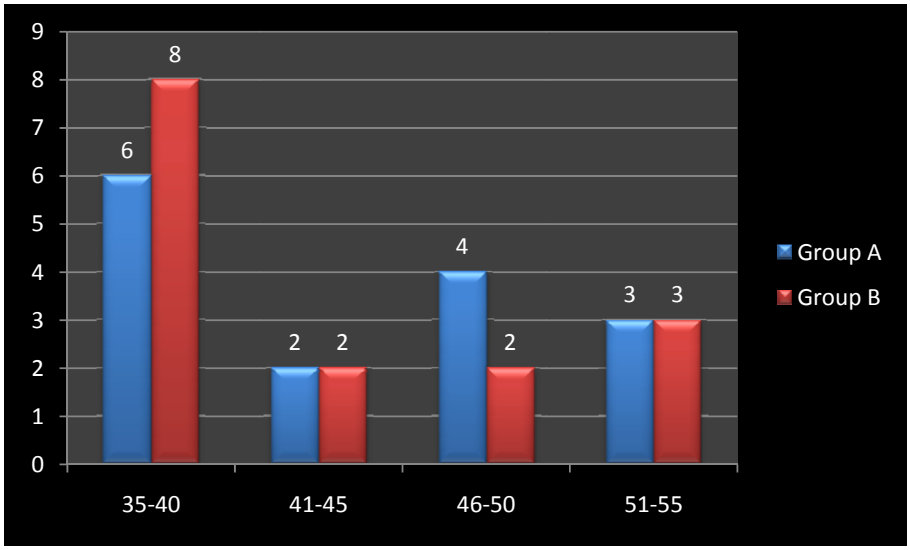
Graph 1: Base line data for demographic variables

Table 2: Age distribution of subjects studied

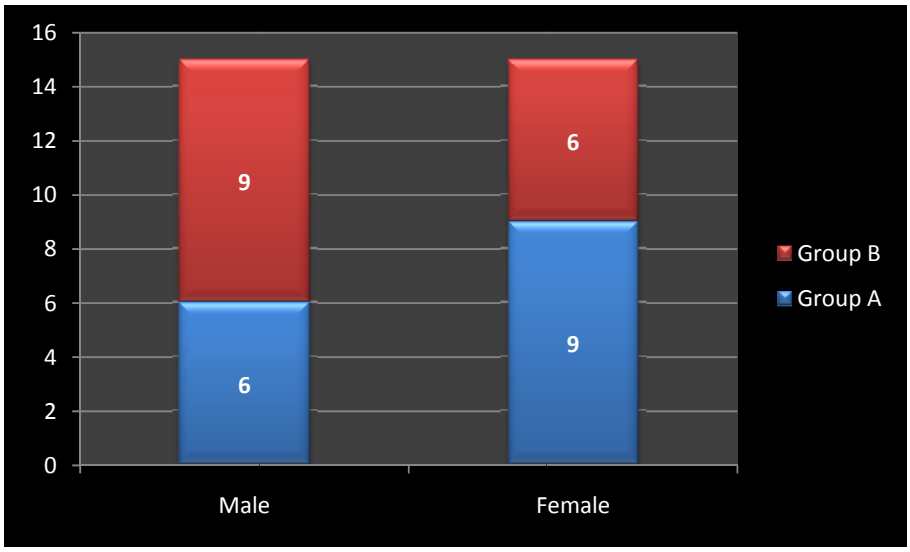
Age in years	Group A		Group B	
	No	%	No	%
35-40	6	40	8	53
41-45	2	13	2	13
46-50	4	27	2	13
51-55	3	20	3	20
Total	**15**	**100**	**15**	**100**

RESULTS :

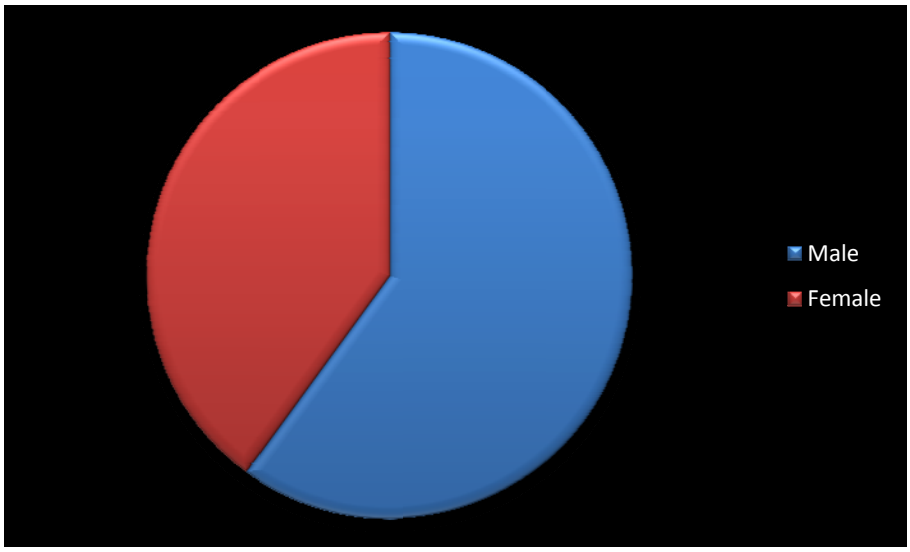
The table shows that in group A there were 6 subjects in 35-40 age group, 2 subjects in 41-45 age group, 4 subjects in 46-50 age group, 3 subjects in 51-55 age group. In group B there were 8 subjects in 35-40 age group, 2 subjects in 41-45 age group, 2 subjects in 46-50 age group, 3 subjects in 51-55 age group.



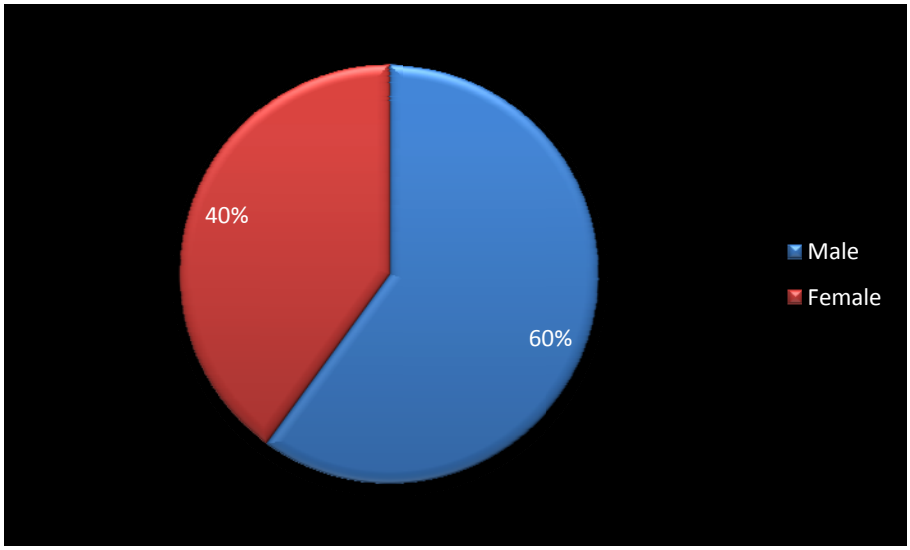
Graph 2 a: Age distribution of subjects studied



Graph 2 b: gender distribution of subjects studied



Group A



Group B

Table 3: baseline data for outcome variables

SI no	Variable	Group A	Group B	P value
1	VAS	8.20±0.86	8.60±0.73	>0.250
2	FFI	0.83±0.3	0.84±0.8	>0.250

RESULTS :

Table shows that mean(SD) : P value of comparison of groups are at baseline. The mean VAS was 8.2 with SD= 0.86 in group A and the mean VAS was 8.6 with SD=0.73 in group B. the mean FFI was 0.83 SD=0.3 and the mean FFI was 0.84 with SD=0.8 and there was no significant difference among both the groups(P value>0.250).

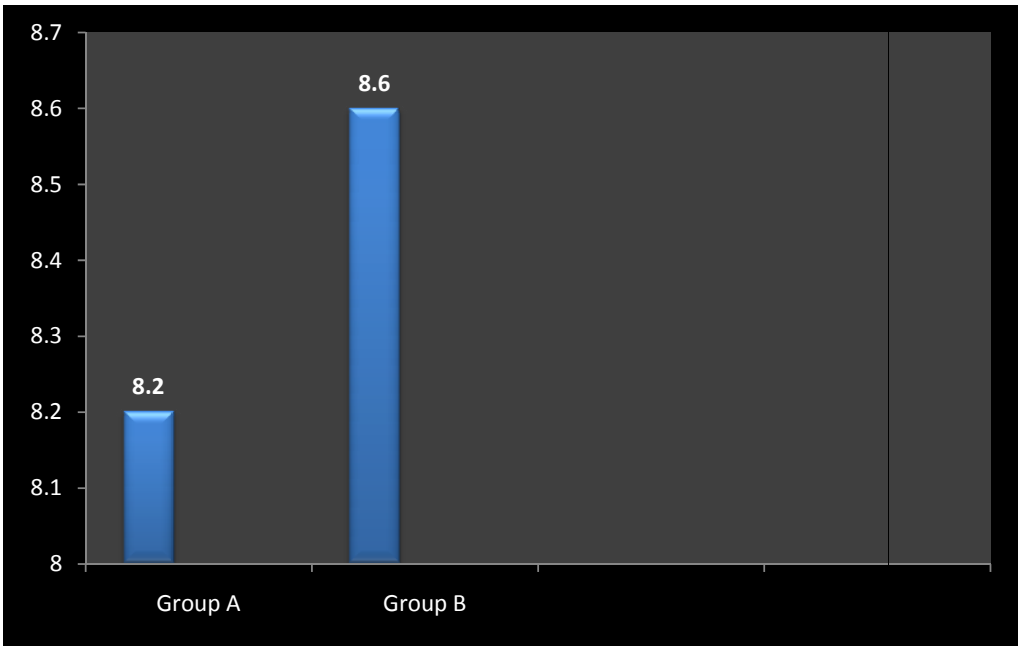
Table 4: Effect of phonophoresis and conventional therapy on VAS and FFI

SI no.	Variable	Pre	Post	P value
1	VAS	8.20±0.86	3.4±0.50	<0.001
2	FFI	0.83±0.3	0.38±0.1	<0.001

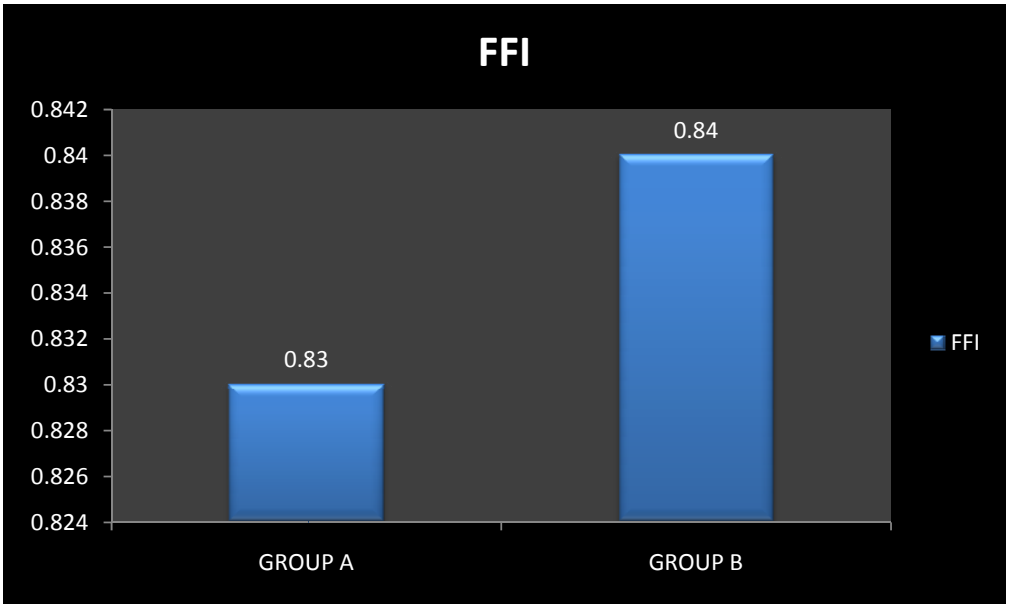
RESULTS :

Data are mean (SD), P value are comparison with in the groups.

The pre mean score of VAS was 8.20 with SD=0.86 and the post score was 3.4 with SD=0.50 in group A and the difference is statistically significant (P value< 0.001). The pre mean score of VAS was 8.60 with SD=0.73 and the post score was 4.66 with SD=1.1 in group B and the difference is statistically significant(P value <0.001).



Graph 3 a: Comparison of VAS between two groups



Group 3 b: Comparison of FFI between two groups

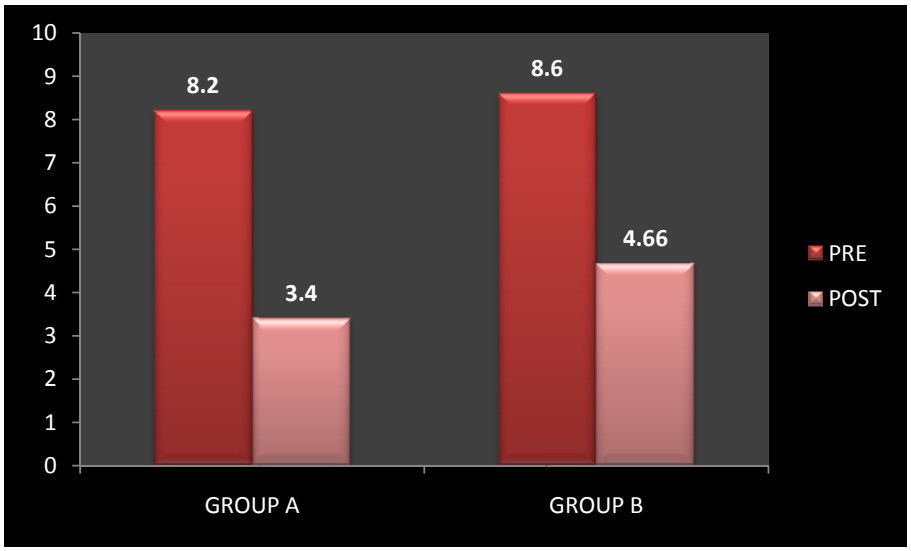
Table 5: effect of MFR and conventional therapy on VAS and FFI

SI no.	Variable	Pre	Post	P value
1	VAS	8.60±0.73	4.66±1.1	<0.001
2	FFI	0.84±0.8	0.53±0.15	<0.001

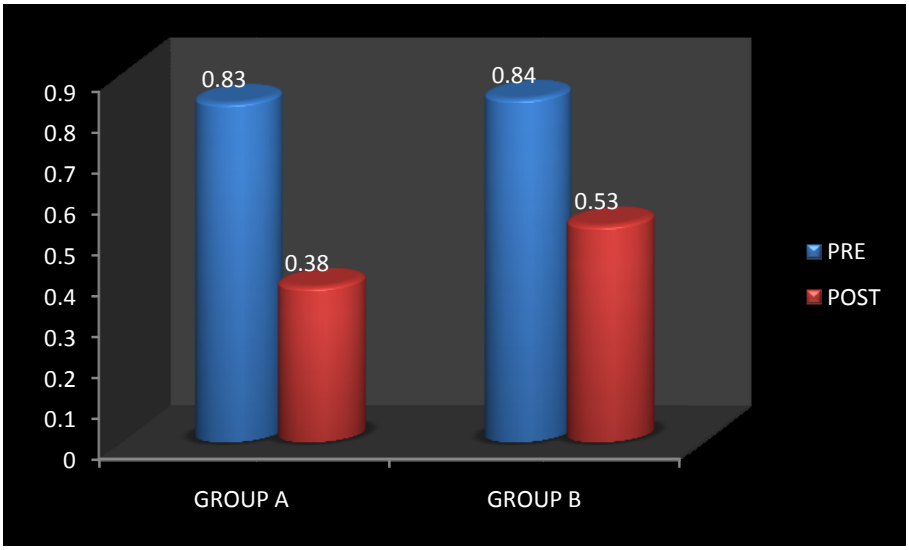
RESULTS :

Data are mean(SD), P value are comparison with in the two groups.

The pre mean score of FFI was 0.83 with SD=0.3 and the post score was 0.38 with SD=0.1 in group A and the difference is statistically significant (P value< 0.001). The pre mean score of FFI was 0.84 with SD=0.8 and the post score was 0.53 with SD=0.15 in group B and the difference is statistically significant(P value <0.001).



Group 4: Comparison of VAS with in the groups



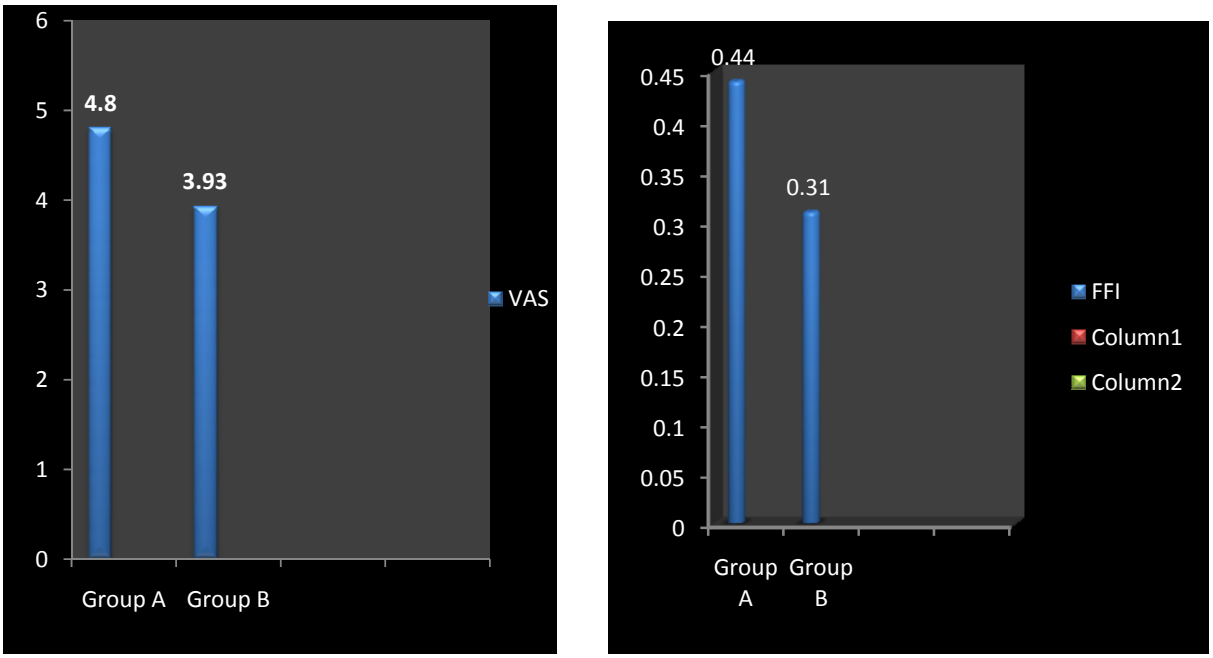
Graph 5: comparison of FFI with in the groups

Table 6: difference between groups

SI no.	Variable	Group A	Group B	P value
1	VAS	4.80±0.94	3.93±1.09	<0.041
2	FFI	0.44±0.09	0.31±0.17	<0.015

RESULTS :

Data mean(SD), p value are comparison between two groups. The mean score of gain in improvement in VAS is 4.80 with SD=0.94 in group A and the mean 3.93 with SD=1.09 in group B which is statistically significant (P value <0.041). The mean score of gain in the improvement in FFI is 0.44 with SD=0.099 in group A and mean 0.31 with SD=0.17 in group B which is statistically significant(P value <0.015).



Graph 6: Comparison of VAS and FFI Between two groups

Plantar fasciitis can be treated by various treatment techniques. Studies have been done on individual treatment and proved effective in reducing pain.

Phonophoresis and Myofascial Release were proved effective in reducing pain individually. The study compared the effectiveness of 2 treatment strategies techniques in subjects with plantarfascitis, appeared that Phonophoresis was effective than Myofascial release in decreasing pain and subjects showed clinically significant improvement.

In Group A treated with Phonophoresis mean VAS score reduced from 8.20 to 3.4 with the p value <0.001 showed statistically significant improvement. The mean FFI score reduced from 0.83 to 0.38 with the p value <0.001 showed statistically improvement. The improvement is in accordance with a study done by Odjel who found out that Phonophoresis is more efficient in reducing pain at rest and in motion.

Yuch-Ling Hsieh concluded that pain relief in phonophoresis may be due to an effect on the central mechanism of nociception. The peripheral influences of US and phonophoresis on the central modulation of the spinal nociceptive processing system are important and may reflect the work being done through the neuroplasticity of spinal cord in response to peripheral input of US and phonophoresis .

Bomana described that phonophoresis cause an increase in local temperature which causes an increase in the cell membrane permeability.

Nancy N By described that phonophoresis increases the kinetic energy of the molecules in the drug and in the cell membrane, dilates the points of entry such as the hair follicles and the sweat glands and increases the circulation to the area sonicated. These physiological changes enhance the opportunity for drug molecules to diffuse through the stratum corneum and collected by the capillary network in the dermis. The mechanical characteristics of the sound wave also enhance drug diffusion by oscillating the cells at high speed, changing the resting

potential of the cell membrane and potentially disrupting the cell membrane of some of the cells in the area. The radiation or streaming forces are forceful to push drug molecules into the tissues.

Ciccone demonstrated that the induced drug may have reduced the formation of prostaglandin through the inactivation of cycloozygenase (an enzyme that converts fatty acid into interstitial swelling) which may have reduced the inflammation at the teno periosteal junction there by reducing the pain.

In the Group B treated by Myofascial release shown mean VAS score reduced from 8.6 to 4.66 with the p value< 0.001 showed statistically significant improvement. The mean FFI score reduced from 0.84 to 0.53 with the p value< 0.001 showed statistically significant improvement. This is in accordance with a study done by Suman Kuhar, who found out that myofascial release is an effective therapeutic option in the treatment of plantar fasciitis. The pain is reduced as there is a change in viscosity of the ground substance to a more fluid state which eliminates the fascia's excessive pressure on the pain sensitive structure and restores proper alignment and there is increase in circulation and increase in venous and lymphatic drainage.

However the statistics shows significant difference between groups i.e. Group A (Phonophoresis) and Group B (Myofascial release) the mean +

- SD VAS for group A was 4.80+ 0.94 while that for Group B was 3.91+1.09 with p value <0.41 and the mean +SD FFI for group A was 0.44+0.09 while that for group B was 0.31+0.17 with p value <0.015 showed statistically significant difference between the groups. The study showed the result where Phonophoresis was found to be more effective in reducing pain and when compared with the Myofascial release in subjects with Plantar Fascitis.

LIMITATIONS

- The follow up to see the long term effects of these techniques is not done
- On sample size was small, and data were collected at few outpatient hospital and clinic limiting the generalizability of the findings
- The study is of short-term duration.

RECOMMENDATIONS

- The period of study should be increased as the disease process is also long hence it may lead to better and valuable results
- Sample size can be increased with inclusion of more number of subjects to generalize the effect in larger population.

The purpose of the studywas to compare the effects of phonophoresis and Myofascial release in reducing pain and improving the function in patients with plantar fasciitis and analyse for any significant variation.

It can be assumed that both Phonophoresis and Myofascial release is effective in reducing pain. But the outcome of this study with significant statistical improvement seen in phonophoresis on the outcome variables than Myofascial release will lead us to the conclusion of accepting the experimental hypothesis which could be stated as Phonophoresis is effective in reducing pain than Myofascial Release.

As there is statistically significant difference between phonophoresis and myofascial release therapy the experimental hypothesis is accepted.

The study can be concluded as

Treatment in phonophoresis is effective in reducing the pain and improving function in the patients with plantar fasciitis compared to the treatment of patients with myofascial release

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APPENDIX – I

Group A - PHONOPHORESIS						
Sl.no	Age	Sex	VAS		FFI	
			Pre	Post	Pre	Post
1	38	M	8	4	0.8	0.42
2	43	F	7	3	0.81	0.37
3	35	F	9	3	0.88	0.32
4	48	F	8	4	0.81	0.4
5	40	M	10	4	0.85	0.44
6	36	F	8	3	0.83	0.32
7	50	F	7	3	0.78	0.35
8	42	M	9	3	0.82	0.38
9	55	F	8	3	0.87	0.31
10	46	M	7	4	0.79	0.36
11	51	F	9	3	0.92	0.76
12	38	M	8	3	0.82	0.33
13	49	F	8	4	0.85	0.34
14	52	F	9	4	0.81	0.38
15	39	M	8	3	0.81	0.34

APPENDIX – II

Group B – MYOFASCIAL RELEASE						
Sl.no	Age	Sex	VAS		FFI	
			Pre	Post	Pre	Post
1	55	F	8	4	0.84	0.4
2	45	F	10	6	0.94	0.55
3	35	M	8	5	0.92	0.44
4	40	M	9	4	0.85	0.4
5	36	F	8	3	0.71	0.6
6	50	M	9	5	0.85	0.42
7	48	F	8	3	0.68	0.8
8	35	M	8	6	0.82	0.7
9	53	M	8	6	0.85	0.4
10	38	M	9	3	0.90	0.67
11	42	F	10	5	0.95	0.76
12	52	M	8	5	0.82	0.41
13	40	F	9	6	0.98	0.70
14	39	M	8	5	0.78	0.41
15	38	M	8	4	0.82	0.4

APPENDIX III

SELECTION CRITERIA OF PATIENTS WITH PLANTAR FASCIITIS FOR THE STUDY

1) Demographic Data:

1.1) Name: 1.2)Age: 1.3)Sex:

1.4) Occupation: 1.5) Address:

2) Chief Complaints:

3) History:

3.1) Present History:

3.2) Past History:

3.3) Medical History:

4) On Observation

4.1) Attitude of foot: (Medical / Lateral weight bearing / normal)

4.2) Gait Pattern:

4.3) Type of foot wear:

4.4) Deformity:

5) On Palpation

5.1) Tenderness:

5.2) Swelling:

6) On Examination

6.1)Range of Motion

Active Movement

Passive Movements

7) Radiological investigations

Diagnostic Imaging x-ray

MRI

8) Pain assessment:

Onset of pain

Site of pain

Type of pain

Duration of pain

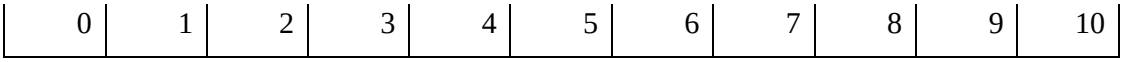
Frequency of pain

Aggravating factors

Relieving factors

9) Subjective assessment:

1. VAS SCALE



No Pain **Worst Pain**

FOOT FUNCTION INDEX

Foot Function Index	PRE-TREATMENT	POST-TREATMENT
In the morning upon takingyour first step?		
When walking?		
When standing?		
At the end of the day?		
At its worst?		
When walking in the house?		
When walking outside?		
When walking four blocks?		
When climbing stairs?		
When descending stairs?		
When standing tip toe?		
When getting up from a chair?		
Index scored on visual analog scale of 1-10,10 being worst		

Interpretation : total from each question and divide by the total possible score

$$\text{FFI} = \frac{\text{TOTAL SCORE}}{120}$$

APPENDIX IV

INFORMED CONSENT FORM

EFFECT OF PHONOPHORESIS AND MYOFASCIAL RELEASE IN PLANTAR FASCITIS – COMPARITIVE STUDY

INVESTIGATOR: MRS. K.CHELLAMMAL

This is to certify that I, …… have been given the following information for the participation in this study.

PURPOSE OF THE RESEARCH

This study is to investigate the effectiveness of Phonophoresis and myofascial release in reducing the pain and improve the function in plantar fascitis paltients.

PROCEDURE

In this study, you get examined for the present status of pain , function and improvement of status after doing treatment.

TIME AND DURATION

You will undergo treatment for continuous 10 days.

CONFIDENTIALITY

Your participation will be confidential. During the research, the datas such as photographs, audio, vedio will be used only with your permission.

REQUEST FOR MORE INFORMATION

You can ask any questions in person regarding the study procedure.

COMPANSATION

There is no compensation or financial assistance for participation in this study.

REFUSAL OR WITHDRAWAL OF PARTICIPATION

You all will have the right to withdraw your participation for any reason by notifying the investigation

I have read and have understood this consent form to participate as a subject in this research study.

Signature of subject…….. Date……..

I have explained about the research project to the above signed volunteer

Investigator:

Signature …… Date ……